In the Claims

Claims 1-40 (canceled)

41. A fluid delivery and removal channel passage structure integrally associated with an electrode structure of a fuel cell system, comprising:

a fluid delivery channel disposed across a first face of the electrode structure;

a fluid removal channel disposed across a second face of the electrode structure, wherein the second face opposes the first face; and

a porous bulk matrix fluid transport layer interposed between the fluid delivery channel and the fluid removal channel, wherein the porous bulk matrix fluid transport layer is adapted to hydrodynamically flow a gas or liquid therethrough, wherein the porous bulk matrix fluid transport layer is in fluid communication with the fluid delivery and the fluid removal channels, and wherein the porous bulk matrix fluid transport layer comprises a sol-gel.

42. A fluid delivery and removal channel passage structure associated with an electrode structure of a fuel cell system, characterized in that the fluid delivery and removal passage structure comprises an inlet passage and an outlet passage separated by a porous bulk matrix fluid transport layer, wherein the porous bulk matrix fluid transport layer is adapted to hydrodynamically flow a gas or liquid therethrough, wherein the porous bulk matrix fluid transport layer is in fluid communication with the inlet passage and the outlet passage, and wherein porous bulk matrix fluid transport layer comprises a sol-gel.

43. A fuel cell system comprising:

an anode derived from a first planar silicon substrate;

a cathode derived from a second planar silicon substrate;

and a liquid electrolyte that ionically connects the anode to the cathode;

wherein the anode and the cathode are spaced apart and substantially parallel to each other so as to define a spaced apart region, wherein the liquid electrolyte is interposed

between the anode and the cathode and within the spaced apart region, wherein the anode has a plurality of anodic porous regions, wherein the plurality of anodic porous regions each comprise a plurality of interconnected mesoporous anodic pores, and wherein the plurality of interconnected mesoporous anodic pores are acicular and substantially parallel to one another.

44. A fuel cell system comprising:

an anode derived from a first planar silicon substrate;

a cathode derived from a second planar silicon substrate;

and a liquid electrolyte that ionically connects the anode to the cathode;

wherein the anode and the cathode are spaced apart and substantially parallel to each other so as to define a spaced apart region, wherein the liquid electrolyte is interposed between the anode and the cathode and within the spaced apart region, wherein the cathode has a plurality of cathodic porous regions, wherein the plurality of cathodic porous regions each comprise a plurality of interconnected mesoporous cathodic pores, and wherein the plurality of interconnected cathodic mesoporous pores are acicular and substantially parallel to one another.

45. (Canceled)